STRATEGY RESEARCH PROJECT

NATIONAL MISSILE DEFENSE – PAST AS PROLOGUE?

BY

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ABSTRACT

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The US is about to repeat history again with respect to development and or intermittent deployment of its fifth 'national' missile defense system. While the world and national politico-military strategic environment are undergoing continuous change, the relevance of the arguments against National Missile Defense deployment remain strong and will effectively delay or thwart employment of even a limited 'national' missile defense. In short, it is déjà vu. Given the increasingly austere DoD budget and somewhat arbitrary Anti-Ballistic Missile (ABM) Treaty demarcation between theater and 'national' missile defense systems (TMD and NMD), funds projected for NMD development would be better utilized in furthering increasingly capable TMD systems that ultimately become capable of NMD-like missions.

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THE NATIONAL MISSILE DEFENSE DILEMMA

> "Over the next two years, there will be increasingly irresistible political forces tending toward the deployment of a national missile defense best characterized as ***'a weapon that does not work against a threat that does not exist.'***"[1]

The conscious competition over how best to provide for the national security of the United States and its interests continues under constant scrutiny. There is no greater responsibility for a representative democracy than to provide for the security of its people. Indeed the competition of ideas is inherent in our balanced democratic form of government, presumably giving rise to the best and brightest strategies available to conquer the volatile, uncertain, complex and ambiguous (VUCA) challenges to national security. Unfortunately as illustrated in the pronouncement above, however, competition often degenerates into debate rather than dialogue, controversy rather than consensus, and results in stalemate rather than decision. Nowhere perhaps is such debate and controversy more contentious than in the case concerning national missile defense, where decades of inaction have become the de facto decision – the political answer to uncertainty.

For many, the current national missile defense debate seems like a new concern, a national security issue born of the evolving post-Cold War era. However, what is now labeled as national missile defense (NMD) has had previous iterations and outcomes known under different names like Anti-Ballistic Missile (ABM), Ballistic Missile Defense (BMD) or Strategic Defense Initiative (SDI). In fact, the 'NMD debate' has raged for over 50 years, producing perhaps the longest development cycle of a non-deployed weapons system in the history of the US defense establishment.

Since the introduction of the ballistic missile by the Nazi's in the final phases of World War II, both U.S and Soviet defense establishments have wrestled with exploiting the missile for offensive purposes while simultaneously preparing to defend against them. As early as the 1950's, the U.S. defense planners developed the Nike-Zeus and later, the Nike-X anti-missile system. In the 1960's and 1970's, the US developed the Sentinel and Safeguard ABM systems, deploying the latter for a mere four months in late 1975 before directing its dismantlement. [2] The 1980's gave rise to the now infamous SDI, better known to its critics as 'Star Wars.' More recently, in recognition of growing regional missile threats, other nations are assessing their requirements for a 'national' missile defense. Now, as we approach the end of the 1990's and the birth of the third millennium, the US is again poised to make a decision on missile defense of its own homeland.

Given these earlier missile defense efforts and corresponding decisions to continue research and development but not deploy NMD, the central question is, should we deploy NMD now – has anything changed? Are the factors that were decisive in concluding not to deploy a nation-wide missile defense in each of the earlier attempts still relevant today? Recognizing that 'those who fail to study history are often doomed to repeat it,' this SRP reviews earlier attempts to develop and deploy NMD in order to make an informed projection about the likely outcome of the current NMD effort. This paper posits that NMD deployment will again be delayed in the year 2000 decision, as it has in the past. In short, it is déjà vu. Moreover, NMD is destined to perpetual research and development unless and until it objectively and holistically overcomes its major opposing factors.

Historically, four factors have consistently influenced the NMD discussion and shaped its outcome. First, necessity or is there a real threat? Second, technical capability, that is, can the threat be countered effectively with available technology? Third, cost – are adequate resources available within imposed resource constraints? Fourth and finally, strategic stability or does the deployment of NMD unnecessarily imbalance existing geostrategic relationships? Each of these factors is dynamic, being both changed by and changing the VUCA environment that envelops it. Thus, each NMD effort and corresponding outcome is a product of the global and domestic setting and strength of each factor at that time, subject to myriad outcomes in different times under varying circumstances. Therefore, by studying these earlier NMD efforts and the relationship of each attempt with each of the determinant factors, one can make a reasonable prediction about the prospect of the current NMD effort and react accordingly to ultimately achieve a desired outcome, presumably NMD deployment.

THE GENESIS OF MISSILE DEFENSE (1944-1955)

The ballistic missile threat materialized on 08 September 1944 in the waning days of World War II when the first of many German V-2s slammed into the undefended population in the heart of London. This new Nazi terror weapon appeared militarily and technologically indefensible. Early calculations determined that traditional anti-aircraft defensive efforts to engage a V-2 with a "barrier of shrapnel" as it approached its target area would actually cause more damage than it prevented.[3] As the V-2 could not then be dealt with defensively, allied planners stepped up their offensive strategic bombing campaign to halt further launches. Despite their best efforts England was targeted by an estimated 1115 V-2s, almost half (518) directed against London resulting in 2754 deaths

and 6523 seriously injured.[4] Fortunately for the US, the war ended before increasingly sophisticated Nazi missile technology became capable of striking the US mainland, as plans had been developed for a German intercontinental ballistic missile (ICBM) attack on New York City.[5] As combat closed in the European Theater, US, UK and USSR forces rushed to capture and later experiment with German rocket and missile technology in recognition of its potential import in future military operations.[6] Meanwhile, in an effort to conclude the ongoing war in the Pacific Theater of operations, US leadership directed the use of an even more terrifying weapon – the atomic bomb. However, not until two atomic weapons were unleashed on Japan did the last remaining member of the Tripartite Pact surrender and World War II officially end.

Before concluding the second world war of the tumultuous twentieth century, the seeds of yet a third world war were sown: the infamous Cold War. Fueled by ideological and political differences and perhaps historically justified suspicions,[7] US and Russian leaders drifted further and further apart – eventually eyeing one another as enemies. These jaundiced perspectives led to the longest and most expensive military arms race and undeclared war in modern history. Not surprisingly, exploitation of 'new' military weaponry, notably missiles and atomic warfare became the focus of the arms race between these potential adversaries. Assessments in the aftermath of World War II foresaw the convergence of missiles and atomic weaponry into a monolithic threat that required the expedited development of new defensive capabilities.

> Guided missiles, winged and non-winged, traveling at extreme altitudes and at velocities in excess of supersonic speed, are inevitable. Intercontinental ranges of over 3,000 miles and payloads sufficient to carry atomic explosives are to be expected. Remotely controlled, and equipped with homing devices designed to be attracted to sound, metal, or heat, such missiles would be incapable of interception with existing

> equipment such and fighter aircraft and anti-aircraft fire. Guided interceptor missiles, dispatched in accordance with electronically computed data obtained from radar detection stations will be required ... the development of defensive measures against atomic weapons [must] be accorded priority over all other National Defense Projects.[8]

Confronted by the horrific vision of a then indefensible and powerfully destructive threat of unimaginable magnitude, the US defense establishment, initially under the direction of the US Army Air Force, hastily began a series of air and missile defense projects. The US Army (USA) initiated a study in June 1945 that proposed its first surface-to-air missile (SAM) system under Project Nike. Nike envisioned the use of two radars, one used to detect the target aircraft and one to guide the missile to intercept under computerized guidance. [9] More focused missile defense projects were underway as early as March 1946: Projects Wizard and Thumper. Though Thumper would be cancelled two years later, Project Wizard was charged with developing a missile that could destroy a [reentry] vehicle traveling up to 4,000 miles per hour at altitudes between 60,000 and 500,000 feet[10] and was sustained under the aegis of the nation's newest service: US Air Force (USAF). These early study efforts derived viable defensive concepts but were hampered by inadequate technical advances of the day. Specifically, "relevant technology in the form of rocket propulsion, guidance, target acquisition, and rapid data processing [were] too primitive throughout the early 1940s and early 1950s to offer much hope for the feasibility of [ballistic missile defense]."[11] Nonetheless, a series of geopolitical developments would validate the worst fears of US leaders and ignite the mandate for further missile defense efforts. First, Chinese Communists defeated the US backed Chinese Nationalists and shortly thereafter concluded a Sino-Soviet Friendship Treaty. Then in September 1949 US intelligence detected clear evidence of a Russian

atomic explosion in the Pacific.[12] Finally, communist aggression on the Korean peninsula all but confirmed communist intent of a worldwide communist revolution. Atomic Armageddon was on the horizon – and it would be delivered by air.

NIKE ZEUS AND NIKE-X (1955-1965)

SETTING. The 1950s were marred by "an uneasy peace."[13] The Korean Conflict distracted US geopolitical attention in the early years of the 1950s, testing the fledgling superpower in its new role as the guarantor of freedom as outlined in the Truman Doctrine. While internationally engaged on a communist containment crusade, Americans at home focused on economic prosperity and domestic reformation. Television gained momentum as a modern medium of information, entertainment, and advertising. Consumerism rose to new heights while families migrated away from city centers and into suburbia. Urban sprawl splintered communities into sub-communities of like-minded individuals, setting the conditions for social consciousness in the ensuing decade. US commitment as the self-appointed keeper of communist containment marked a turning point in the American way of life[14] – one that would shape domestic and international confrontations for the next 40 years. For now, however, buoyant from the end of the Korean War, Americans enjoyed a short-lived "thaw"[15] in US-Soviet relations following Stalin's death and Khrushchev's rise to power, seemingly easing tensions but not alleviating suspicions or fears.

THREAT. As America's first limited war against communism halted in northeast Asia, US defense planners continued to build and enhance continental defenses oriented against an anticipated Soviet air attack, based upon the massive growth of Soviet Air Army to over 1000 Tu-4 bombers.[16] Soviet capability to attack the US mainland was real,

not imagined, though intent was uncertain. While the ideological battle between communism and democracy was joined, the technological battle was quickly elevated to a new medium – space. The successful Soviet launch of Sputnik in 1957 suggested grave implications for the security of the US in a nuclear age. No longer dependent upon bombers, the Soviets now had the means to attack its superpower adversary with a weapon for which there was no established defense. The pursuit for a viable missile defense took on a renewed priority, as did the birth of the US space program.

Responding to the escalating communist threat, both the USAF and USA pursued continental air defense under a variety of incarnations.[17] This dual arrangement was the source of growing inter-service rivalry as both services established developmental programs for continental air defense. Eventually, the competition had to be resolved by the Secretary of Defense and in 1956, he established an arbitrary demarcation in responsibility: the USAF responsible for missile offense and area defense while the USA was responsible for point defense.[18] For area defense, the USAF pursued BOMARC[19], an air-breathing, winged interceptor guided by ground radar to intercept its target at relatively long range.[20] The Army, meanwhile, expanded upon its highly successful Nike SAM. Tested in 1951, by 1954 the Nike-Ajax SAM was deployed throughout the US, defending major industries and population centers. As the Army developed plans to enhance the range and warhead of its new SAM with a larger, nuclear capable missile, the Nike-Hercules, it contracted with Bell Laboratories for review of future air defense requirements, including defense against ballistic missiles. The resulting Nike II Study determined that a defense against ICBMs was possible,[21] setting the foundation for work on a new anti-missile missile system, Nike-Zeus. Eager to obtain a strategic role, the

Army began touting air and missile defense as it's defensive contribution to strategic deterrence. Recognizing its then sole claim of strategic deterrence was under attack, the USAF responded by advertising the limitations of Nike-Zeus. Inter-service bickering resumed in earnest. By early 1958, Secretary of Defense McElroy again had to intercede and on 16 January 1958, based upon Army success with the Nike SAM, directed the Army to take the lead in developing an ABM system. Though the services would wrangle over roles and missions in the future, the significance of McElroy's decision is that the Army became the Department of Defense (DoD)'s principal advocate for missile defense.[22]

CAPABILITY. Nike-Zeus employed a delicate combination of four radars, command and control, and missile interceptors to search, track, engage and destroy an incoming ICBM. Incoming missiles were to be detected first by the long range Zeus Acquisition Radar (ZAR). The ZAR then 'handed over' the missile to the Discrimination Radar (DR) which was to determine if the missile trajectory was threatening. Once within the range of the intercepting Zeus missile, the threatening missile track was again passed to the Target Track Radar (TTR). Once a decision was made to engage the threatening missile, the Zeus was launched and guided to a pre-determined terminal intercept by a separate Missile Tracking Radar (MTR). Once within the proximity of the ICBM, the nuclear warhead was command detonated and the target would be destroyed. Results of testing of Nike-Zeus were mixed. While accomplishing an intercept on 22 December 1962, it was unable to discriminate between the warhead and decoys. Additionally, since Zeus's radars were mechanically steered, it was capable of producing only a single radar beam for guidance, hence it could only intercept one target at a time.

Finally, scientists were unsure of the nuclear electromagnetic effects on Zeus radars, postulating that the first nuclear blast might blind or damage the guidance radar, precluding subsequent engagements.

Limitations in the capabilities of the Nike Zeus gave rise to Nike-X in 1963, the first two-tiered missile defense system. Improved radar technologies enabled a reduction in the number of radars from four to two required to identify, track and intercept attacking missiles. The Multi-function Array Radar (MAR) would provide for long-range detection, identification and tracking of attacking missiles and enabled discrimination of the warhead from decoys. A second Missile Site Radar (MSR) would guide either longer range Spartan (a modified Zeus) or shorter range Sprint missiles to intercept. The MSRs multifunction capability facilitated multiple beam generation and therefore, multi-target engagements. Additionally, improved missile technology enabled the development the faster accelerating Sprint interceptor.

COST. Costs for Nike Zeus, and later Nike-X, were prohibitive and politically unacceptable. Nike Zeus procurement estimates coupled with inconclusive effectiveness led Secretary of Defense McElroy to discourage Congress from authorizing monies for Nike Zeus production in 1959. Moreover, with the approaching presidential elections, political leaders did not want to embark upon a costly 15 billion-dollar deployment.[23] As Nike Zeus evolved into Nike-X, costs only escalated. In fact, as cited in a Defense Department estimate, costs grew to be "so great that only a few cities could be defended."[24] Research and development continued while the USA pressed repeatedly but unsuccessfully for deployment, still in pursuit of a coveted strategic mission.

STRATEGIC BALANCE. US offensive nuclear superiority throughout the late fifties and early sixties greatly influenced the US calculus of strategic balance. So did a series of unsuccessful ABM experiments, highlighting the difficulty of an effective missile defense as an equal complement to missile offense. DoD's recently created Advanced Research Projects Agency (ARPA) conducted a variety of novel technological approaches to the ABM problem, but failed to achieve a breakthrough. Project Argus attempted to neutralize attacking nuclear warheads through atmospheric saturation of electrons produced by a US nuclear explosion in space but the electrons dissipated too rapidly. Projects Defender and BAMBI (ballistic missile boost intercept) orchestrated myriad intercept technologies[25], including early forms of what is now known as 'Brilliant Pebbles' (on orbit intercept vehicles) but did not achieve intercept. While these experiments added to the body of ABM knowledge, they also reinforced in decision-makers minds the necessity of retaining and later pursuing strategic balance through proven offensive means.

Only the emergence of a new threat and reluctant recognition of domestic political realities would eventually result in deployment of a Nike-X-like system under a series of new names and only then for a relatively brief period.

SENTINEL AND SAFEGUARD (1966-1976)

SETTING. The period surrounding the development and announced deployment of Sentinel by the Johnson Administration and Safeguard by the Nixon Administration has been appropriately called the SALT (Strategic Arms Limitations Talks) decade.[26] It might also reasonably be called a decade of contradiction and conflict. Extreme domestic and global turbulence and turmoil marked the sixties and continued into the seventies. At

home, US social consciousness reverberated in a number of movements throughout the country. Most visible were multigenerational demonstrations against the unpopular and increasingly costly war in Vietnam. Second, the Nation's youth rebelled in advocating a counterculture reflecting the antithesis of responsibility: drugs, sex and rock-n-roll. Finally, encouraged by earlier passage of the Civil Rights Act and Voting Rights Acts, civil rights activists led rightful causes that spawned a visible sequence of racial clashes. Such domestic discontent and discord manifested itself in a series of assassinations. Internationally, the superpower arms race spiraled upward while the US continued its Truman Doctrine crusade in an escalating conventional conflict with the communists in Vietnam. Even mankind's most daunting technological achievement of placing Neil Armstrong on the surface of the moon and returning him safely to earth in July 1969 shed little light on the VUCA overcast dominating this period. The change of presidential leadership and party affiliation did little to quell the impurity of the period when President Nixon resigned in disgrace in the wake of the Watergate scandal. In sum, the period was a paradoxical mosaic of distrust. And in the midst of this confusion, the complex missile defense issue was debated publicly, reflecting the division of the times.

THREAT. Heretofore, the missile defense issue was relatively simple – the threat was not yet mature nor were technological capabilities sufficient to effectively counter the projected nuclear missile threat. Relatively low research and development costs were considered as a necessary hedge against surprise that could be met with costlier deployment if or when needed. Both the US and USSR were adding to the quantitative and qualitative character of their offensive nuclear arsenal, essentially maintaining the strategic balance of the superpowers. However, by 1966 the international balance of

power was beginning to change, potentially destabilizing worldwide peace as the so called nuclear parity of the two superpowers were challenged by a third entrant: China. In May 1966, US intelligence detected a Chinese nuclear explosion affirming their thermonuclear capability. A short while later, the Chinese successfully launched a nuclear-armed missile, striking its intended target. Subsequent Chinese nuclear test explosions in December 1966 and again in June 1967 left little doubt as to Chinese capability. [27] Although the Chinese threat was cited publicly as the catalyst for deciding to deploy US ABM capability, events in the Soviet Union were no less alarming.

The Soviets, like the US, had deployed air defenses surrounding its major cities and industrial complexes. Earlier deployments of the GRIFFON and SA-5 SAM systems were suspected of having an inherent ABM capability. Deployment of a new missile system, the GALOSH, with reported ABM capability, however, represented a departure from the established offensive deterrent of ICBMs. A Soviet ABM by itself, revealed by Secretary of Defense McNamara in his Sentinel announcement, would not have tipped the scales in favor of deployment. Undoubtedly, increasing Soviet momentum in building and enhancing its nuclear ICBM arsenal well beyond parity with the US weighed heavily on the begrudgingly derived decision to deploy a US ABM. As noted in a Spring 1967 warning to the House Armed Services Committee, "... available evidence indicates that the Soviet Union has a goal of strategic superiority designed to win a nuclear war rather than merely deter one..."[28] Indeed, the USSR was escalating deployment of its 'heavy' SS-9s and developing new SS-18s while the US was unilaterally holding its nuclear ICBM fleet to 1054. Even more alarming was the

potential introduction of Multiple Independently Targetable Reentry Vehicle (MIRV) technology, greatly increasing the distribution of nuclear warheads on modified ICBMs.

CAPABILITY. Technologically, the Sentinel ABM system was nothing more than a deployment concept of the earlier Nike-X system hardware. It employed the same MAR (now called PAR – Perimeter Acquisition Radar) and MSR radars and engaged with any of a combination of nuclear-tipped Spartan and or Sprint missiles. When announced by McNamara on September 1967, the deployment envisioned a 'thin' continental defense of urban industrial areas against the projected 1970s emerging Chinese ICBM threat.[29] Deployment comprised 6 – PARs, 17 – MSRs, 480 – Sprint and 220 – Spartan missiles, spread among 17 sites in the continental US, Alaska, and Hawaii.[30] The deployment was to provide an initial operational capability within 54 months and not exceed a total cost of $5 billion dollars.

Owing to the political power change following the national election of 1968, President Nixon directed a security policy review shortly after his inauguration in January 1969. In compliance with this review, new Secretary of Defense Laird directed a halt to Sentinel deployment in February 1969. Over the next 30 to 60 days, the Packard Commission specifically analyzed the ABM issue, developing four courses of action, recommending a reorientation in the program toward ICBM defense. President Nixon adopted recommendation, announcing it as Safeguard on 14 March 1969.

Likewise, Safeguard represented nothing more than a name change rather than a technological reorientation. Safeguard's mission and corresponding deployment scheme, however, differed from Sentinel. Safeguard was designated to defend existing US ICBM missile fields as opposed to major cities and industrial centers, reducing basing

requirements to 12 sites. This deployment scheme avoided some of Sentinel's difficult political landmines such as employment of nuclear weapons in the vicinity of population centers and selection of which cities to defend, and in contrast, not to defend. Safeguard would be deployed in phases, beginning with immediate construction of two sites at Grand Forks AFB, North Dakota and Malmstrom AFB, Montana. Safeguard declared initial operational capability on 28 September 1975 only to be directed to terminate operations on 10 February 1976 as ordered by Congress.

ABM technology had not improved appreciably from earlier efforts demonstrated under the Nike-Zeus and Nike-X programs. A rudimentary capability had already been demonstrated in tests conducted under the Nike-X program. However, in directing the deployment of Sentinel and subsequently, Safeguard against an unsophisticated Chinese threat, contemporary technology was deemed sufficient for a limited defense against a limited threat. In essence, the US embarked upon the Soviet path to research and development – deploy evolving capability and improve it as experience dictates.

COST. Cost remained a significant though not decisive consideration. As viewed by Secretary of Defense McNamara, cost advantage inured to the offense by a factor of four to one.[31] Accordingly, McNamara was reluctant to begin expending precious resources toward a missile defense system that was at best only marginally effective, particularly against the larger Soviet threat. Moreover, costs of Vietnam were increasing rapidly and there was no end in sight. Further, $5 billion dollars was an extensive sum of money for a limited defense, particularly in consideration of the immense costs of President Johnson's Great Society programs. Costs were also a factor affecting Army attentiveness. In earlier incarnations, the Army aggressively pursued missile defense as a

conduit to the strategic mission that garnered a significant percentage of defense department resources.[32] However, with its Vietnam presence and commitment increasing its share of the defense budget, the Army no longer needed missile defense missions to seek resources.[33]

STRATEGIC STABILITY. Strategic re-balancing was the primary factor generating the decisions to first deploy Sentinel, and later, Safeguard. The Sentinel deployment decision announced by McNamara was a compromise with President Johnson. McNamara remained convinced throughout his tenure that missile defenses were incapable of effectively defending against the vast Soviet ICBM inventory. His Sentinel compromise was a political relief valve for his president to do something about the growing missile threat [34] while establishing conditions for arms limitations talks with the Soviets. Therefore, McNamara perceived Sentinel as a negotiating means to a greater end: de-escalation. Though Johnson would be denied the opportunity to fully negotiate with the Soviets due to the results of the pending national election, he set the stage for Nixon's extended SALT negotiations. Nixon too, saw ABM as a tool to pressure the Soviets to halt their advance in offensive nuclear arms. Over the course of six major negotiating conferences and two and one-half years,[35] US and Soviet representatives haggled over the merits of balance between ABM and ICBMs. Throughout these extensive negotiations, each side had different objectives based upon their perceptions of the value of ABM in the overall strategic balance. The USSR coveted their missile defense, insisting upon retention of their GALOSH defense and the freedom to build others. Conversely, USSR negotiators feared the contribution of ABM to US strategic strength. On the other side, US representatives followed the McNamara-ian

interpretations of ABM, viewing it as an ineffective weapon conceived of only as a bargaining chip to a complicated parley. Recognizing the US congressional support for ABM was marginal at best, Soviet negotiators extended negotiations hoping that the US Congress would unilaterally terminate the ABM program and its import to strategic re-balancing. In the end at signing ceremonies in Moscow on 26 May 1972, US negotiators prevailed in linking defensive concessions with offensive concessions in the SALT I accord, while the Soviets achieved a stunning ABM victory by way of the ABM Treaty. Victory was made all the sweeter when the US unilaterally terminated ABM operations at its only operational missile defense site four years later. Deterrence, and therefore strategic balance, was maintained through US reliance on offensive nuclear capability juxtaposed with Soviet offensive and defensive capabilities.

Mutual assured destruction (MAD) held both superpowers hostage to a perceived geostrategic stability until a new US leader would abruptly challenge that assertion.

STRATEGIC DEFENSE INITIATIVE (1983-1993)

SETTING. SDI, like the decade in which it was conceived reflected a sense of rebirth, essentially a "new morning."[36] Following the haunting failures of Vietnam, of Desert One, and of the unfulfilled promise of détente, the US began the eighties with a feeling of doubt [37] – doubts not only about domestic concerns but also about the wisdom of the persistent bipolar challenge to US foreign policy. Then in 1981 along came an optimist, a visionary who gazed upon the consistently complex geopolitical landscape with a broad view and a plain-talking positive perspective of what could or should be – President Ronald Reagan. America was revitalized and this renewed spirit of democracy and its power gradually captivated the world. The US economy awoke and, over time,

reshaped itself into an engine of change that continues to move the world economy forward even today. East-West challenges in the Caribbean were answered with the US invasion of Grenada in 1983. Democratic reformation germinated and spread throughout Eastern Europe and later onto Asian soil in China. In Reagan's second term, another equally clairvoyant leader, Mikhail Gorbachev, emerged in the USSR and set into motion a momentous series of changes leading eventually to the dissolution of the Soviet Union and the end of the Cold War. Gorbachev's three painful programs of glasnost (openness), perestroika (restructuring), and demokratizatsiya (democratization) attempted to rebalance his "Third World country ... with a First World military."[38] Cataclysmic events throughout the eighties and into the early nineties, including the Challenger explosion, rising domestic violence, the AIDs pandemic, the Chinese Tiananmen Square massacre, the Panama invasion, the collapse of the Soviet Union, and the Gulf War heightened fears, looming like a harsh weather front in unpredictable winds. Such rapid and dramatic changes caused many to fear the consequences of the unknown as the comfort of bipolar competition gave way to multi-polar uncertainty.

Unlike earlier missile defense efforts, SDI was not a specific weapon system but rather a research and technology development program. More than that, it reflected a major shift in strategy and even philosophy. Beyond the uniqueness of SDI's apparent reversal of longstanding policy was its top-down source – President Reagan himself in televised speech on 23 March 1983, stating:

> " ... Wouldn't it be better to save lives than to avenge them? [whereupon the President called for] ... the scientific community in our country, those who gave us nuclear weapons, to turn their great talents now to the cause of mankind and world peace: to give us the means of rendering these nuclear weapons impotent and obsolete ... [cautioning that] ... defense systems have limitations and raise certain problems and ambiguities. If

> paired with offensive systems, they can be viewed as fostering an aggressive policy, and no one wants that ... [announcing that he was] directing a comprehensive and intensive effort to develop a long term research and development program to begin to achieve our ultimate goal of eliminating the threat posed by strategic nuclear missiles. This could pave the way for arms control measures to eliminate the weapons themselves."[39]

Such a prescient and remarkable statement ignited the kindling of earlier opposition efforts and renewed national and worldwide discussion about the relevance of a national missile defense in the current strategic equation.

In the transfer of presidential leadership to President Bush in 1989 and in the context of a rapidly changing geopolitical environment, SDI was redirected toward a less ambitious and more specific missile defense effort: Global Protection Against Limited Strikes (GPALS).

THREAT. The SALT accords and ABM Treaty had held positive promise but were overshadowed by an unrelenting nuclear buildup in both quantity and quality. Throughout the delicate debates between the superpowers, US negotiators hoped that concessions in ABM deployments would eventually yield a freeze or even reduction of nuclear arms. However, the defensive-offensive limitation link that the US had sought to maintain was clearly, and arguably, deceptively broken. Having won an advantageous ABM limitation, the Soviets steadily enhanced their offensive posture. Circumventing the earlier agreed accords, the Soviet ICBM arsenal was enlarged tremendously simply by replacing limited but undefined 'heavy' ICBMs (SS-9s) with an even 'heavier' ICBM (SS-18) and adding unlimited 'light' ICBMs (SS-19s).[40] The introduction of MIRVs to both ICBMs and submarine launched ballistic missiles (SLBMs) increased the number of nuclear warheads almost four-fold. In sum, SALT and ABM resulted in adding to, not

subtracting from, the madness of the previously validated MAD doctrine. Such unthinkable destruction was the subject of a 1983 ABC movie The Day After, "detailing the aftermath of a nuclear war [and] recording a viewership of 100 million."[41] The threat had once again become real and palpable and US government action was required.

CAPABILITY. SDI took a broad, technological assessment of a variety of means to interdict the menacing threat of a growing arsenal of ballistic missiles. Moreover, SDI, considered interdiction throughout the 'lifetime' of ICBM flight using existing and projected technological advances along two approaches: kinetic energy and directed energy.[42] For the first time, BMD evaluated technological solutions to engaging ICBMs from launch to impact, opening the door for radically different weapon systems. Additionally, significant technological advances in sensor detection and tracking coupled with vast increases in computing speeds and software capabilities improved the prospects for a viable missile defense.[43] Kinetic energy kill concepts included the traditional ground-based nuclear and non-nuclear interceptors and space-based battle stations. Kinetic kill mechanisms simply placed force on force by placing another object in the path of high velocity attacking missiles and warheads. The combination of improved sensors and rapid calculations made possible non-warhead kills through direct impact. Homing to impact in space was proven feasible in the Homing Overlay Experiment in June 1984.[44] Directed energy considered a plethora of relatively new sciences with weaponry potential including: chemical lasers; excimer lasers; free electron lasers; X-ray lasers; and particle beams. Lasers and particle beams place electromagnetic energy or subatomic particles directly on the target missile or warhead for a sufficient time in order to weaken or deform it to initiate an internal catastrophic failure. To focus sufficient

energy requires intensely accurate tracking and pointing, "equivalent to hitting a television set in Los Angeles from directly over New York City."[45]

With the exception of ground-based interceptors, new technical solutions to the complex BMD problem were criticized as immature and unachievable. Further, because many of these evolving weapons would either be space-based or be aimed through space assets, arguments against the 'militarization' of space were rekindled and opposition rose. Finally, the experimentation with new, so-called exotic technologies to solve heretofore unimagined complex defense problems generated both scientific and political criticism, cynically dubbing the program 'Star Wars' and equating it with fantasy.

COST. Costs of deploying theoretical SDI technologies were immense, even in the context of the Reagan defense buildup and deficit spending. Critics used a variety of estimates, each as inaccurate as the proponents for no final architecture was ever determined. Nevertheless, on the high end, estimates ranged from 300 to 500 billion dollars distributed over a thirty-year period.[46] Costs of this magnitude were driven up by virtue of the overarching goals of SDI, that is, to render all ICBMs impotent. However, while perhaps conceivable in isolation, when considered in competition for other national needs, costs for a comprehensive BMD were simply not affordable.

STRATEGIC BALANCE. As before, SDI was the product of the increasingly unevenness of the superpower strategic equation. The massive Soviet buildup of nuclear delivery means and weapons was reaching ominous proportions resulting into what was termed a "window of vulnerability."[47] By 1985, DoD estimates indicated that Soviet SS-18 ICBMs could destroy 80 percent of the US land-based nuclear deterrent.[48] In response, both the Carter and Reagan Administrations developed strategic offensive

modernization, concocting an elusive basing scheme for the modernized 'Peacekeeper' ICBM to complicate and deter any Soviet considerations of a preemptive first strike. Reversing earlier logic to hold US citizens vulnerable to nuclear attack was not the sole objective of SDI. More importantly, SDI was to diminish defensive vulnerability through a buildup of the US technical base to enable the future deployment of a missile defense deterrent to future strategic balance equations. In short, it created uncertainty for our Soviet adversary about the value of the sunk costs of their offensive advantage. Gorbochev, cognizant of the 'bargaining chip' nature of Safeguard, was skeptical of US commitment to SDI. Nonetheless, the Soviet leader perceived SDI as a direct threat to the strategic equilibrium.[49] Following a series of unsuccessful efforts to derail SDI, the Soviets pursued Strategic Arms Reductions Talks (START) in earnest and the balance of terror was finally on the decline. Once again, US intent to deploy NMD had repaired the superpower strategic imbalance.

However, new entrants to the 'ICBM club' would soon change the perception of strategic balance, rekindling the NMD issue at the dawn of a new millennium.

NATIONAL MISSILE DEFENSE (1993 – PRESENT)

SETTING. Momentum from the earlier decades of progress propelled the Nation and the world steadily toward the promise of a new millennium. The march of capitalism and democracy in the American style continued its reach throughout the world, though in many places and in many ways it did not proceed unchallenged. The collapse of Soviet communism enabled the reunification of Germany while conversely exposing long suppressed economic, ethnic and religious tensions resulting in a myriad of catastrophes. While the twin engines of economic and democratic change sped forward, much to

American benefit, a third engine came to life again that would offer hope to the world and mankind – technology. Convergence of many mature technologies resulted in more capable computers and software, rapid worldwide communications, continuous mass media coverage, all leading to the rise of instantaneous information and the emergence of the so-called information age. The resulting information flood and condensing of facts with fiction facilitated an 'attention deficit disorder' approach to developing crises and problems. As the sole remaining superpower, Americans leadership abroad was essential but simultaneously became targets of violence and discontent. Rifts widened between economic and technological 'have and have-nots.' Polarizing events in the 1990s briefly focused national and in many cases worldwide attention on a range of issues and concerns but never long enough to develop and implement long-term solutions. US politics became more and more partisan and poisonous. The promise of fiscal responsibility embodied in the Balanced Budget Amendment was threatened by an evident and ever increasing risk assumption in national security. Moreover, impeachment of President Clinton by a republican majority late in 1998 exacerbated old rivalries, further dividing the electorate within itself and from their representatives and associated policies. In sum, as 1999 edges closer to 2000, the variety and vastness of US interests has created an almost indistinguishable policy prioritization. Though on the verge of achieving advancement of US objectives to unprecedented heights, the US is potentially reaching a policy culminating point that dictates caution.

President Clinton's 1992 election platform was primarily domestic, requiring a further exploitation of the 'peace dividend' at the further expense of defense budgets. Accordingly, Secretary of Defense Aspin executed a Bottoms-Up Review (BUR) in 1993

that among other cuts drastically reduced spending for missile defense.[50] The Bush GPALS Program was reoriented to emphasize improvement of Theater Missile Defense (TMD) and a reduction of the NMD effort to a technology preparedness program. Clinton missile defense policy was initially unclear but evolved over time into what has been called 'three plus three.' The Administration's NMD policy calls for: (1) development of NMD elements by the year 2000 that could be deployed within a subsequent three years to protect the US against a limited "rogue" nation ballistic missile attack as well as an accidental/unauthorized launch from nuclear capable states; (2) given that a missile threat exists in 2000, decide to deploy or not deploy the NMD system by 2003; (3) given that no credible threat exists in 2000, continue to develop NMD systems deployable within three years of threat identity and deployment decision. Additionally, in pursuit of it's 'three-plus-three' program, the Administration reaffirmed support of the ABM Treaty, citing it as the "cornerstone of strategic stability" and constraining any developed missile defense elements to compliance with the Treaty, as revised.[51]

As recently as January 1999, Clinton missile defense policy appears to be changing. Secretary of Defense Cohen has announced a change to 'three-plus-three' indicating a possible intent to deploy NMD by 2005.[52] Simultaneously, Secretary of State Albright has initiated talks with her Russian counterparts about necessary adjustments to the ABM Treaty.[53] Predictably, both Russian and Chinese leaders have signaled displeasure with the US over a possible NMD deployment.

Operationally, the proposed NMD system is essentially a modernized Safeguard. NMD architecture includes a battle management, command, control, and communications element (BMC3); upgraded early warning satellites known as Space Based Infrared

Satellites (SBIRS); upgraded early warning radars (UEWRs); additional ground-based radars; and ground-based interceptors.[54] Unlike its terminal defense predecessor, NMD will destroy enemy reentry vehicles using a hit-to-kill exoatmospheric kill vehicle (EKV) as opposed to a nuclear proximity detonation. Also different will be NMD's missile launch vehicle, using a commercial-off-the-shelf (COTS) launch platform.[55] Likely deployment sites for the initial deployment are in Clear, Alaska and Grand Forks, North Dakota.

Major determinant factors are aligning in NMD's favor. Earlier in the decade, the ICBM threat was more or less constant, limited to the major missile powers of Russia and China. However, Russian political instability and recent missile developments in "rogue nations" such as North Korea and Iran have heightened national security concerns. Moreover, technology continues to improve at exponential rates making the complex missile to missile intercept an ever-greater possibility. Costs, although significant, appear supportable for a limited deployment of a limited system. Finally, with ICBM inventories on the decline in both Russia and the US, the deterrence linkage of missile defense to offset ICBM inventories may no longer be relevant, at least from a US perspective. As a result, prospects for a positive NMD deployment decision are brighter today than they have been since the Safeguard deployment decision.

THREAT. Administration threat assessments reflected the decisions to reduce the NMD effort, but would later be revised upward. In support of the BUR reorientation, a National Intelligence Estimate was prepared in 1995, indicating rogue nation ICBM missile threats were thought to be 10 to 20 years away. Moreover, Russian and US ICBM inventories were at last declining in accordance with START 1 and deeper

reductions only awaited Russian ratification under START 2. In short, the missile threat was at long last thought to be decreasing. Congressional NMD proponents, primarily republicans, saw a bleaker picture. Former Secretary of Defense Rumsfeld was commissioned by the republican dominated congress to study the missile threat and released a contradictory assessment of a credible ICBM threat to the US mainland within five years.[56] As if to underscore the credence of the July 1998 report, Iran and then North Korea subsequently test launched missiles with surprising sophistication. The latter three-stage North Korean launch, once perfected, could threaten US interests in the Pacific, Hawaii or even Alaska. Finally, while Russian missiles were being systematically destroyed, Chinese ICBMs were undergoing a modernization program. Thus, while the 'rational actor' missile threat was somewhat diminished, the irrational rogue missile threat was a cause for increasing alarm.

CAPABILITY. NMD relies on the "proven" concept and technologies of its ancestors, modernized with the latest advancements. Building upon existing infrastructure and experiments, the system's risk is driven primarily by expediting deployment timelines. To posture the program for deployment readiness, DoD's Ballistic Missile Defense Organization (BMDO) awarded a contract to Boeing in April 1998 as Lead System Integrator (LSI) responsible for "designing, developing, testing, and fielding NMD." As LSI, Boeing must integrate the efforts of a variety of subcontractors to design and build NMD elements for a full system test sometime in 1999 to support a Deployment Readiness Review in 2000.[57] Shaken by a relentless sequence of failures of TMD systems like the Theater High Altitude Air Defense (THAAD) system and an incredibly tight timeline, Boeing has a tremendously difficult burden not to fail.

COST. Cost estimates and funding for NMD have varied greatly but remain austere. During the 1993 BUR, overall funding for missile defense was halved and priorities heavily oriented toward TMD. Consequently, NMD development suffered. Before 1996, while in a technology readiness status, estimates for the period fiscal year 1998 through 2003 totaled $2.3 billion. However, once upgraded to a deployment readiness posture in April 1996 and following the rigor of the Quadrennial Defense Review, cost estimates were revised, doubling to $4.6 billion. A BMDO explanation for such a disparity in estimates cites the immaturity of earlier designs and corresponding estimates. More deliberate designs and estimates were provided for the QDR and independently validated.[58] Nonetheless, funding at these austere levels impose high technical risk. Current funding supports a bare minimum of component, ground, flight and integrated tests. Consequently, only 16 NMD flight tests are programmed within existing funding constraints compared to 111 for Safeguard before it became operational.[59] As currently programmed, funding for even a limited NMD deployment appears woefully inadequate.

STRATEGIC STABILITY. Strategic stability may be jeopardized by a US NMD deployment. Strategic balance of power under START 2 is approximately equal without considering the contributions of a national missile defense for either country. Recent US signals of intent to deploy NMD have elicited public outcries of US betrayal of the ABM Treaty by Russian leaders. Russian concerns, cognizant themselves of the growing missile threat, are more likely in recognition of their dire financial predicament and inability to rebuild and deploy similar systems. Shocked by an apparent Clinton policy reversal, Russian leaders have reportedly threatened to withhold ratification of the

START 2 Treaty.[60] Likewise, China has decried NMD deployment as aggressive.[61] Thus, renewed US intent to deploy NMD has reawakened both major ICBM adversaries to the potential instability of missile defense. Such instability, however, may only be temporary, calculated to forward START 2 ratification and renew ABM Treaty and arms control regimes.

CONCLUSIONS

Completing this 'historiographical' journey of the legacy of NMD has been revealing. NMD in all its forms has a long, erratic but predictably repetitive past. Although the erratic support of NMD has been observed before,[62] it has not been adequately explained nor used in a coherent consideration of a renewed NMD effort. In fact, the repetitious nature of past and current missile defense efforts validates Professor Jablonsky's "time arrow-time cycle" construct.[63] Indeed, history can and often does repeat itself. Moreover, the relative continuity of determinant opposing factors further strengthens the Jablonsky concept and helps to explain the repetition of events and corresponding outcomes. Accordingly, **while the US leadership is rhetorically posturing to deploy a limited NMD capability, determinant factors have not been overcome and the US will not deploy NMD in the near-term.**

Current determinant factor weights and conditions for a June 2000 NMD deployment decision are approximately equal to those experienced in the Safeguard era. In fact, similarities among the determinant factors are striking. As before, the shadow of the ballistic missile threat is closing, though the sources are now multiple. While China allegedly served as the 'nth country' threat driving the Safeguard decision, "rogue nation" missile capabilities coupled with weapons of mass destruction potential elevates

current concern. Technical approaches to NMD, that is terminal defense, are unchanged. Proven through extensive testing of Safeguard, proof of concept for an advanced NMD remains to be demonstrated in very limited testing. Like its ancestor, abbreviated timelines and austere resourcing rather than technical capability create daunting technical challenges and associated risk. As before, NMD is advertised as a limited system, so as not to intimidate US-Russian power equations. And as before, a limited system will always be subject to operational concerns that a limited defense can be overwhelmed by a more sophisticated threat or conversely, circumvented by a less sophisticated means. Cost considerations are also similar. While Safeguard costs were constrained by the national costs of Vietnam and the Great Society programs, sustaining domestic programs within Balanced Budget limitations today contains NMD costs. Finally, Clinton Administration support for NMD appears to be motivated more by political concerns rather than fears of a looming missile attack. In fact, as used by both the Johnson and Nixon Administrations, recent support for NMD looks suspiciously like a bargaining chip for use in negotiations with the Russians to expedite ratification of agreed START 2 reductions. Déjà vu.

Throughout its over 50-year history, US deployment of NMD has been stunted by the collective effect of four decisive factors as well as the VUCA environment in which non-deployment decisions have been made. Its long non-deployment history now becomes a fifth decisive factor and a new obstacle. As such, NMD will be subject to contemporary opposition that will not soon be overcome. Regrettably, the US will not deploy a NMD system until the threat becomes so ominous that the citizenry demands it (most likely after an actual missile attack) and is equally willing to pay for it. When or if

this demand presents itself, missile defense research and development programs and the technology of the day will hopefully provide at least a rudimentary capability against further attacks by a moderately sophisticated threat. Hope, however, is not a viable method for shaping US policy nor executing US national security programs.

Word Count = 7,934.

ENDNOTES

[1] John Pike, "Ballistic Missile Defense: Is the US 'Rushing to Failure,'" Arms Control Today, April 1998, 9.
[2] Ballistic Missile Defense Organization, "Missile Defense Milestones 1944-1997," undated; available from http://www.acq.osd.mil/bmdo/bmdolink/html/milestone.html. Internet. Accessed 30 September 1998.
[3] Donald R. Baucom, The Origins of SDI, 1944-1983, (Lawrence, KS: University Press of Kansas, 1992), 4.
[4] Gregory P. Kennedy, Vengeance Weapon 2, (Washington, D.C: Smithsonian Institution Press, 1983), 40.
[5] General Board, US European Theater, Anti-Aircraft Artillery Section, "V-2 Rocket Attacks and Defense," late 1945 or early 1946, 4 and 18, quoted in James A. Walker, Frances Martin, and Sharon S. Watkins, Strategic Defense: Four Decades of Progress, (Washington, D.C.: US Army Space and Strategic Defense Command, 1995, 1.
[6] Kennedy, 52-67.
[7] Peter Jennings and Todd Brewster, The Century, (New York, NY: Doubleday, 1998), 292.
[8] Ruth Jarrel and Mary T. Cagle, History of the Plato Missile System, (Redstone Arsenal, AL: US Army Ordnance Missile Command, 23 June 1961), 110-111 quoted in Walker, Martin, and Watkins, Strategic Defense: Four Decades of Progress (Washington, D.C.: US Army Space and Strategic Defense Command, 1995), 4. Primary source is also citing from an unnamed report of the War Department Equipment Board chaired by GEN Joseph W. Stillwell circa 1945 or 1946.
[9] James D. Crabtree, On Air Defense (Westport, CN: Praeger Publishers, 1994), 120.
[10] Headquarters US Air Force, , Semi-Annual Progress Report of the Guided Missile Program (Air Force Technical Committee, Wright-Patterson AFB, OH 31 October 1949), 49-51 quoted in Baucom, Origins of SDI, 1944-1983, 7.
[11] David N. Schwartz, "Past and Present: The Historical Legacy," in Ballistic Missile Defense, ed. Ashton B. Carter and David N. Schwartz (Washington, D.C.: Brookings Institution, 1984), 331.
[12] Jennings and Brewster, 308, 311.
[13] Ibid., 282. Historians of The Century actually use the phrase "an uneasy peace" to describe the post-WWII years of 1946-1952, but I have applied it to the 'Arms Race' period amplified in the fifties.
[14] Ibid., 318.
[15] Ibid., 322.
[16] Crabtree, 123.
[17] Ibid. 121-130. The USAF established Continental Air Command (ConAC) as directed by presidential order in 1948. Six US based numbered air forces were subordinated to ConAC as was the Air Defense Command (ADC). In 1950, the USA established Army Anti-Aircraft Command (ARAACOM) comprised of EASTARAACOM and WESTARAACOM in parallel to ConAC's interceptor structure. Also in 1950, the USAF reorganized ConAC into the ADC and both service's commands were co-located at Ent Air Force Base, Colorado. In 1954, the USAF again reorganized, converting ADC to the Continental Air Defense (CONAD). North American Air Defense Command (NORAD) was established in 1957, partnering the Royal Canadian Air Force with the responsibilities and functions of CONAD. In 1958, the Army renamed its continental air defense organization into ARADCOM as it became a missile based force.
[18] Baucom, 8-11.
[19] Crabtree, 121and 127. BOMARC is an acronym combining the names of its developers, Boeing Aircraft Company and Michigan Aeronautical Research Center.
[20] Ibid., 127.
[21] Baucom, 7.
[22] Ibid., 14.
[23] Ibid.
[24] American Enterprise Institute for Public Policy Research, The Safeguard ABM System (Washington, D.C.: American Enterprise Institute, 20 July 1970), 3.
[25] Baucom, 15-17.
[26] Ibid., 51.
[27] Ibid., 27 and 34.
[28] American Enterprise Institute for Public Policy Research, 31.

[29] Baucom, 25.
[30] James A. Walker, Frances Martin, and Sharon S. Watkins, Strategic Defense: Four Decades of Progress (Washington, D.C.: US Army Space and Strategic Defense Command, 1995), 33.
[31] Baucom, 33.
[32] Carter and Schwartz, 332.
[33] Baucom, 38.
[34] Ibid., 31.
[35] Ibid., 51-71.
[36] Jennings and Brewster, 466.
[37] Ibid., 423-463.
[38] Ibid., 505.
[39] Reagan, Ronald W., televised speech, 23 March 1983 as quoted in Strategic Defenses by Office of Technology Assessment for Congressional Board of the 99th Congress (Princeton, NJ: Princeton University Press, 1986), 37.
[40] Keith B. Payne, Strategic Defense: "Star Wars in Perspective" (Lantham, MD: Hamilton Press, 1986), 164.
[41] Jennings and Brewster, 493.
[42] Office of Technology Assessment for Congressional Board of the 99th Congress, 141-146.
[43] Ibid., 159-169.
[44] Ibid., 156.
[45] Ibid., 148.
[46] Payne, 230.
[47] Office of Technology Assessment for Congressional Board of the 99th Congress, 55.
[48] Ibid., 18.
[49] Payne, 74.
[50] "Ballistic Missile Defense Program Funding." Linked from BMDO Link at "Budget and Legislative Guidance," available from http://www.acq.osd.mil/bmdo/bmdolink/html/budget.html; Internet; accessed 30 September 1998.
[51] "National Missile Defense: An Overview of Alternative Plans," Arms Control Today, January/February 1998, 38.
[52] "Special Defense Department Briefing With Defense Secretary William Cohen," Federal News Service, 20 January 1999.
[53] Barry Schweid, "Yeltsin Criticizes US Missile Plans," Associated Press on CompuServe NewsRoom, 26 January 1999.
[54] Henry L. Manuel and John W. Cummings, Jr., "Aggressive Defense, Preparing the Ground for Deployment of the NMD System is No Small Task," Missiles – Munitions – Armor, Volume 2 Issue 5, 12.
[55] Janes Information Group, "National Missile Defense Interceptor Booster Selected," Janes Missiles & Rockets, September 1998, 15.
[56] Anthony Kimery, "The Cold War is Over, But the Missile Threat Isn't," Missiles – Munitions – Armor, Volume 2 Issue 5, 10-11.
[57] Henry L. Manuel and John W. Cummings, Jr., 12.
[58] US General Accounting Office, National Missile Defense: Even With Increased Funding, Technical and Schedule Risks are High, (Washington, D.C., June 1998), 6.
[59] Ibid., 18.
[60] Schweid, 26 January 1999.
[61] _____, "China Criticizes US Missile Plan," Associated Press on CompuServe NewsRoom, 24 January 1999.
[62] US General Accounting Office, Ballistic Missile Defense, Evolution and Current Issues, (Washington, D.C.: US General Accounting Office, July 1993), 15. Figure 1.1 depicts DOD BMD Program and Research and Development funding from 1955-1993 in 1993 constant dollars.
[63] Jablonsky, David. "Time's Arrow, Time's Cycle: Metaphors for a Period of Transition," Parameters (Carlisle, PA: US Army War College, Winter 1997-1998), 4-27.

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